**A case for integrated systems research**

Notes:

1. Insert a text box with examples of ISR vs ‘traditional’ research

2. Refer to efficiency, avoiding unintended consequences, compatibility, etc

Integrated agricultural systems research (ISR) is needed because farm households face numerous and complex decisions as system managers themselves. System research brings together ecosystem processes, including production as well as natural resources, household livelihood perspectives and the need to operate as an enterprise in engaging with the markets. It embraces innovative approaches that: (i) aim at place-based system intensification and diversification beyond increases in single staple food productivity; (ii) pursue system intensification by minimizing trade-offs and exploiting synergies and complementarities between system components particularly tree-crop-livestock-soil-water interactions; (iii) give equal importance to the system productivity, natural resource integrity as well as policies, markets & institutions dimensions of farming and livelihood systems and recognizing their dynamic interactions as a key area for systems research; (iv) frame the integrated research approach within the context of farming systems at different levels of intensification thus allowing nuanced approaches to scaling up of best-fit technologies; and (v) take an explicit integrated methodological approach that blends local and technical knowledge on productivity enhancement linked to markets and the sustainable management of natural resources.

Integrated systems research supports adoption and integration of technical, market, governance and policy options capable of improving agricultural livelihood systems. ISR fosters connectivity with markets and value chains and collaboration among farming households, communities and development partners. The activities and components in agricultural systems interact, and ISR can help to quantify and foresee how proposed changes affect the overall performance of the system for different productive, socio-economic and environmental indicators. As such, ISR allows putting newly developed innovations and technologies in a larger perspective. By doing this, the focus shifts from smaller to larger scales, for example by evaluating what the effect of a new crop variety is on biophysical aspects of the farm and landscape (productivity, mitigation of pollution, etc.), but also on socio-economic aspects of the household and community (income, gender equity, etc.).

The research improves the understanding of place-based social, financial, technical and environmental contexts providing a knowledge resource to enhance the targeting and relevance of potential systems interventions with an aim to scale these out to similar extrapolation domains. ISR addresses the heterogeneities in landscapes and populations that are encountered when deploying innovations to larger target groups and scaling out. It acknowledges that the requirements for innovation and adaptation are dependent on the local biophysical conditions and on the endowment and socio-institutional setting of the household. Therefore, various methods such as spatial analysis and household typologies are available to analyze these heterogeneities and to exploit them to support scaling out of technologies. Moreover, ISR can analyze the dynamics of systems over time, thus allowing assessment of interventions risks and thereby guiding a stepwise approach to sustainable intensification of agricultural production.

Systems research strengthens the science-policy interface that has prevented governments and international bodies from delivering changes on the ground to rural people. Since ISR focuses on multiple performance dimensions (or goals) of systems at the same time, it allows quantifying tradeoffs and synergies among indicators in a straightforward and intuitive way (Figure 1). Because it provides insight into implications of adoption and behavioral changes at larger scales beyond the plot level, it is highly suitable for evaluation of development outcomes and can support identification of appropriate policy instruments, e.g. to choose between different incentive schemes and extension efforts. The tools used in ISR allow the construction of ‘what if’ scenarios and exploration of windows of opportunity for future development and system dynamics. These explorations can be performed under different scenarios of changes in external conditions such as policies, markets, and biophysical and climatic conditions. This allows a quantitative assessment of adaptability and resilience to for instance climate change, policy regimes and market volatility.

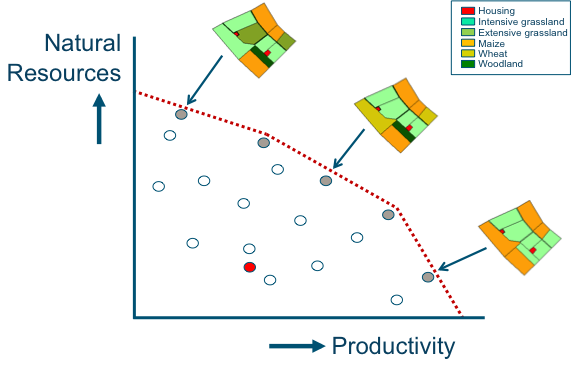


Figure 1. Illustration of model-based analysis of a trade-off (dotted, red line) between productivity and natural resources indicators, as affected by differences in land-use within a given landscape. Each circle represents an alternative way to manage the landscape; the red circle indicates the original performance.